



New High Performance Computing Projects Supported by DOE

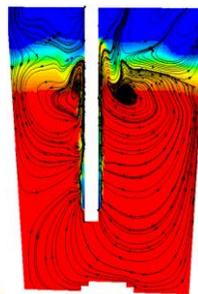
A collaboration between CIVS and Lawrence Livermore National Labs (LLNL) using High Performance Computing (HPC) to improve steel industry processes, is being supported by the Advanced Manufacturing Office and the Department of Energy. CIVS students and staff have been working with researchers at LLNL to use HPC to make simulations significantly faster allowing researchers to tackle problems that would have previously been impractical. The following are collaborated projects:



HPC Analysis of Blast Furnace Operation – This project aims to significantly reduce computational time in CFD simulations of blast furnaces, to enhance current virtual blast furnaces by increasing simulation resolution and by integrating all models for the whole blast furnace system, and to develop integrated blast furnace simulators for process control, optimization, design, troubleshooting and workforce training.

Scaling Study of Steel Ladle Simulation Using HPC – This study aims to increase the resolution and runtime of industrial steel ladle simulations, and identify bottlenecks and roadblocks for scaling CFD simulations of the ladle process. This will help to optimize steel mixing within ladles which is important for producing clean steel.

Optimize the E-Iron Nugget Process – The E-Nugget process is a new ironmaking process converting iron ore to pig iron nuggets using clean, inexpensive, renewable biomass. A computational model of Carbontec's pilot scale E-Nugget reactor will be created and validated. With a validated model, the process will be optimized and scaled to attain an operational capacity of 100,000M tons/yr. [More Information](#)



U. S. Steel Corporation Joins the Steel Consortium

U. S. Steel has recently become a Charter member of the Steel Manufacturing Simulation and Visualization Consortium (SMSVC). U. S. Steel was ranked the 15th largest steel-producing company worldwide in 2014 by the World Steel Association. Other current charter members include AK Steel, ArcelorMittal, NUCOR, Steel Dynamics Inc., and SSAB. The mission of the consortium is to use simulation and visualization technologies to make steel manufacturing more viable across its value chain. Projects will be conducted in the critical areas of operational efficiency, energy efficiency, reliability and maintenance, workplace safety, workforce development, environmental impact, raw materials and smart manufacturing. Companies interested in becoming members and participating in the project selection process should enroll now. For more information, visit www.steelconsortium.org



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9 Undergraduate Research Grants Awarded to CIVS

Nine teams of undergraduate students mentored by CIVS were awarded research grants for their senior design projects.

The winning projects include:

- Fall Protection Simulator for Industrial Safety
- Interactive Steel Building Design Module
- Flash Furnace for Copper Smelting
- Virtual Blast Furnace using VR and AR
- Virtual Steel Plant Training Model Using CFD and VR
- Ball Bearing Replacement Simulator for Wind Turbine
- Optimization of a Bottom-Blow Basic Oxygen Furnace
- Optimization of an Alumina refinery Ductwork Using FEA and CFD
- Development of an Industry Plant Logistics Management System



Other faculty mentors involved in these projects include Dr. Don Gray and Dr. Chien-Chung Chen. These projects, when completed, will help industry by increasing employee safety, optimizing processes, and developing systems for increased efficiency.

Bronze Reliability Award

CIVS Research Engineer Bin Wu (left) and U. S. Steel’s George Cingle III (middle) accepted the Bronze Reliability Achievement Award for “Life Prediction in Industrial Equipment”, a collaborative project that was presented at last year’s AISTech conference. [More Information](#)



Mixed Reality Simulators for Wind Energy Education



Mixed Reality Simulators for Wind Energy Education is a project sponsored by the U.S. Department of Education. The project developed simulators using virtual reality, augmented reality, mobile devices, desktop PC, and the web for students and workers. The project provided a foundation for an NSF-funded automotive technician virtual

simulator that CIVS is developing with AMTEC, a collaboration of community colleges, and industry.

The simulators included: 1) 3D Virtual Turbine; 2) Maintenance, Troubleshooting, and Safety Simulator; 3) Wind Turbine Design; 4) Wind Turbine Template; 5) Wind Turbine Wakes; 6) Wind Farm Siting; and 7) Control & Monitoring. The simulators were piloted and evaluated in courses at Carnegie Mellon University, Ivy Tech Community College – Lafayette, Kalamazoo Valley Community College, Purdue University Calumet, Purdue University West Lafayette, and Riverland Community College. Simulators were found to improve student motivation and learning outcomes. The simulators and accompanying education materials are available online at www.windenergyeducation.org.



Electrical Engineering Professor Collaborates on Automation for Steel Industry



Dr. Don Gray is collaborating with CIVS to develop new software tools for the steel industry. The initial focus has been on the areas of rolling and plant scheduling. Dr. Gray is working with CIVS students and staff to create new targeted tools to aid in process improvement and increased efficiency.

Professor Gray has an extensive background in modeling and simulation ranging from hybrid electric vehicles to industrial processes and control systems. He has delivered graduate courses on the creation of simulation tools supporting process modeling, optimization and hardware-in-loop test system development to students from companies across the US such as Honeywell, General Motors, Ford, Daimler-Chrysler, Caterpillar and John Deere among others.

CVIS Welcomes Dr. Mark Johnson



On Oct. 2nd, the Department of Energy Advanced Manufacturing Office Director, Dr. Mark Johnson, visited CVIS and experienced an augmented reality (AR) demonstration, several

3D visualization videos, and interacted with technologies such as Oculus Rift, Google Cardboard, and the “Steel Wheel”. He praised CVIS for “doing great work”. He was invited by CVIS to chair a panel in the 2015 Northwest Indiana Manufacturing Summit. Dr. Johnson also visited ArcelorMittal.

“It’s very impressive. We are bringing advanced technology and cutting edge technology to the traditional backbone industrial sectors and with that we can drive competition,”

- Dr. Mark Johnson, Director, Advanced Manufacturing Office

World Steel Delegates Visit CVIS

25 executives who represented steel industry companies worldwide visited CVIS on October 13th, coming to the center from the World Steel Conference in Chicago. They were shown several examples of completed 3D simulations and visualizations that have successfully led to real-world improvements and savings for the steel industry. They also learned more about how the center can help steel manufacturing in the U.S. as well as internationally and were introduced to the Steel Manufacturing Simulation and Visualization Consortium. [Full Article](#)



CVIS Director was an Invited Panelist at Summit

CVIS’ Director, Dr. Chenn Zhou, was a panelist for the Advanced Manufacturing Technologies Panel during the 2015 Northwest Indiana Manufacturing Summit. In her final remarks, she concluded, “People say a picture is worth a thousand words, but a 3D interactive simulator is worth a thousand pictures.” More information: [NWI Life Article](#) [NWI Times Article](#)

Steel Rocks! Video Showcased at Materials Science & Technology Conference

CVIS developed a video for the 2015 Materials Science and Technology (MS&T) event for introducing high school students to the steel industry. The video shows the steelmaking process in 3D and important applications to people’s lives. Over 500 students attended the event and visited the numerous stations in groups of 20.



Student Successes – Eric Giboyeaux

Eric Giboyeaux joined CVIS in 2013 and is an undergraduate student in Electrical Engineering that will graduate in fall of 2015. He began school at Purdue University Calumet in 2007 and received a B.A. in Communication with a Public Relations concentration in fall of 2014.

At CVIS, Eric played a vital role in the creation of the Steel Manufacturing Simulation and Visualization Consortium website. He maintains both the Consortium and the CVIS websites, keeping them up-to-date and compliant with accessibility standards. He has written two procedures for organizing the center’s marketing materials and bridges the communication gap between the technical world and the general public. Eric plans to complete a Master’s Degree in Business Administration and pursue a career in engineering sales.



New Study: 3D Tech & Learning

Approximately 70 PUC biology students took part in an experiment aimed at studying the impacts of 3D displays in biology labs. The research is being conducted by Dr. Radmila Sarac in collaboration with CIVS. During the experiment, students were split into two groups which were exposed to two different ways of learning about proteins. One group used 3D monitors with polarized glasses to visualize the proteins, the other used standard 2D monitors.

The research is expected to help understand the role of 3D displays in learning.



Improving Safety through Virtual Reality

CIVS researcher, John Moreland, and U. S. Steel Canada collaborator, Joanne Zaraliakos, presented research on the development of interactive 3D safety training at the 2015 AIST Safety and Health Fundamentals Conference. The presentation was a continuance of work that was created through the Don B. Daily Memorial Fund using real-world incidents and hazards to create interactive 3D simulations that immerse trainees in realistic scenarios. The presentation included demonstrations with portable virtual reality including the Oculus Rift and Google Cardboard. The research is expected to improve safety for the steel industry worldwide by providing more engaging training for industry workers.



Serious Game Design Contest

The Department of English is having a serious game design contest in which the participants will propose a serious game design for pedagogical use. These games will be similar to the games created by CIVS in partnership with Dr. Cohen and Dr. Mabrito. The winning design will be created by CIVS in spring of 2016. Faculty at PUC, Northwest Indiana colleges and public schools are invited to submit proposals. The submission deadline is December 1st. More information: <http://englishlectureseries.org/contest/>



CIVS Facts and Impacts (Since 2009)

- \$38++ million savings for companies
- \$11+ million in external grants and contracts ([Full List](#))
- 92 external organizations collaborated with CIVS
- 142 completed projects
- 120+ technical publications
- 208 national and local news
- 800+ students employed and mentored
- 3,700+ students used CIVS for virtual labs
- 82 Purdue Calumet faculty and staff collaborators
- 44 student awards
- 48+ undergraduate research grants (since 2011)
- 20,000+ local and global visitors

Office of Institutional Advancement – Giving to CIVS



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